K.5

	EUMETSAT POLAR SYSTEM	**EUMETSAT** Doc. No. : EPS/GRE/REQ93002 Issue : 1 Date : 16-July-93

EUMETSAT

POLAR

SYSTEM

EPS GROUND SEGMENT

TECHNICAL SPECIFICATIONS

PHASE - A : System Design & Feasibility Study

EUMETSAT
Am Elfengrund 45 , 6100 Darmstadt, Germany
Tel: +49 6151 9500 * Fax: +49 6151 950125

DOCUMENT SIGNATURE TABLE

Name	Function	Signature	Date
Prepared by **A.** Buelens	EPS Ground Segment		16/07
Approved by			
Approved by			
Released by **M. Langevin**	Programme Manager		16/7/93

DOCUMENT CHANGE RECORD

Issue 1	16-July-93		

TABLE OF CONTENTS

Total number of document pages: 40

1 INTRODUCTION

1.1 Purpose

EUMETSAT are preparing the EPS mission, jointly with ESA, to provide continuity of data from low earth orbiting polar satellite. EUMETSAT will take over with ESA the provision of the METOP satellites, and EUMETSAT will operate the morning mission. NOAA will continue to provide and operate the afternoon mission.

The purpose of this document is to specify the EPS Ground Segment high level functional requirements for phase A - System Design and Feasibility study. The EPS Ground Segment comprises an Operation & Control segment and an Application segment. The present Technical Specifications cover the entire Ground Segment including both Operation & Control and Application segments.

1.2 Scope

The Phase A study prime objective is to establish the foundation for a flexible system design of the overall EPS Ground Segment, and to evaluate the different options currently considered. It is therefore the choice of EUMETSAT to address top level requirements, and to leave the Contractor enough freedom to explore different architecture to come up with the most adapted system concept.

1.3 Structure of the document

Section 2 provides the list of applicable and reference documents.

Section 3 gives an introduction to the EPS mission by summarizing background information which are useful to understand the context of the ITT, while more specific information can be found in the applicable documents.

Section 4 presents the approach which has been adopted by EUMETSAT for the Ground Segment system concept and the way the various functions have been broken down for the definition of the functional specifications.

Section 5 covers the End User Requirements for the overall EPS mission by referring to the corresponding applicable documents. The process of gathering user requirements for the meteorological mission is well advanced while the requirements for the climatology mission are still at an earlier stage.

Section 6 contains the Ground Segment functional requirements. It comprises general system requirements, functional requirements and a list of options to be investigated. Each elements identified in the system concept description is specified by means of a list of functional requirements.

Section 7 defmes the functionalities to be provided by the external interfaces and describes the content of the exchange which is performed. The full agreement of the interface definition with the external entities concerned will not be achieved before the placing of the phase A contract. EXJMETSAT will utilise the phase A study to progress the definition and specification of the interfaces'requirements.

Section 8 is a glossary of all acronyms utilised in the context of the EPS Preparatory Programme.

1.4 Conventions

The qualification of TBD (To Be Defined) following a statement made in this document indicates those elements which need to be defined by the Contractor.

The qualification of TBS (To Be Specified) following a statement made in this document indicates those elements which need to be defined by EUMETSAT.

The qualification of TBC (To Be Confirmed) following a statement made in this document indicates those elements which need to be further analyzed before a final decision can be reached

2 DOCUMENTS

2.1 Applicable Documents

The following applicable documents for this study accompany the ITT.

- AD-1: This document : EPS Ground Segment Technical Specifications

- AD-2: EUMETSAT Polar System End-User Requirements Document EPS/MIS/REQ/93001

2.2 Reference Documents

The following reference documents will be made available to the Contractor at the kick-off meeting.

- RD-1: EPS Mission Requirements Document EPS/MIS/REQ/93002

- RD-2: Review and Feasibility Study on Algorithms for Meteorological Products Extraction from EPS Measurements - Executive Summary EUMETSAT contract EUM/CO/92/ 14 1 /DRP

- RD-3: METOP-1 Space Segment Requirement Specification ME-RS-ESA-SY-0001 LP/4/9003/RH/nr

- RD-4: EPS Ground Segment interface to the User Community EPS/GIF/REQ/93004

- RD-5: EPS Ground Segment interface to NOAA EPS/GIF/REQ/9300 1

- RD-6: EPS Ground Segment interface to IASI (CNES/ASI) EPS/GIF/REQ/93002

- RD-7: EPS Ground Segment interface to ESA EPS/GIF/REQ/93003

- RD-8: DRS characteristics for users CD/AD/201/CMM - Issue 4 - November 1989

- RD-9: Feasibility of adaptation of the MDD encryption scheme for EPS Final report - EUMETSAT contract EUM/CO/91/90/DRP

-RD-10: Low Rate and High Rate Picture Transmission (LRPT/HRPT) Global Specification - Revision 2.2 - February 1993

3. BACKGROUND

3.1 The EPS Mission

The METOP satellite, together with the NOAA satellite system, forms part of an integrated system of meteorological polar satellites providing global data every six hours. The METOP satellite operates in the morning orbit and the NOAA satellite in the afternoon orbit. The principal objective for the EPS Ground Segment is to provide quality controlled data from imagery and sounding instruments operating in a polar orbit to the meteorological centres of the EUMETSAT member states, to NOAA and to the WMO weather forecast centres. The provision of these data needs to be both timely and continuous. The EPS system has also a local meteorological mission to provide local users with data of their area via direct broadcast.

In addition to this meteorological mission, the EPS system carries a Search and Rescue transponder to locate aircraft and ship in distress, a Space Environment Monitoring (SEM) instrument, and a number of climate monitoring instruments which are considered to fly under the METOP scenario, The candidate instruments and the content of the climatology mission are currently under definition. Provision has been made to accommodate climatology activities within the Ground Segment system concept.

3.2 EPS System Overview

Both the EPS and NOAA satellites record the measurements performed by their instruments along each orbit and dump the resulting data once per orbit. Two stations acquire these measurements. The first one, which is part of the EPS Ground Segment, will be situated in northern Europe (Kiruna - TBC) for the morning satellite, the other one under NOAA responsibility, is located at Fairbanks (Gilmore) for the afternoon satellite. Every day each satellite passes in the visibility of its own ground station for a limited number of orbits, depending on the ground station location. Therefore each satellite relies on the other satellite ground station for the reception of data recorded during the orbits which are not covered by its own ground station. These blind orbit measurement data are then routed to their corresponding ground segment along with the measurement data received by the ground station from its own satellite during visibility. This exchange of data between EUMETSAT and NOAA provides a global earth coverage every six hours. Each entity distributes to its own user communities the global data and products corresponding to both satellites.

A global EPS system overview is presented in figure 3.1. It shows the end-to-end process starting with the earth observation by the instruments on board the spacecraft until the distribution of the geophysical products to the end user community. The direct equivalence between the geophysical products, presented as a map of the earth surface, and the situation at a given time on the earth surface allows the EPS system to be represented by means of a layered end-to-end communication model. In this model, the information to be transmitted from one end to the other end, is the earth parameters which are permanently observed by the spacecraft instruments and received by the user community as map of geophysical

products. This representation shows the parallel between the operations performed on board the spacecraft and the corresponding functions to be implemented on ground. It also clearly identifies the functions related to processing of the information, hereafter called the applications; and the communication functions responsible for the delivery of the information between the application entities on board the satellite and on ground. However, this simplified model does not include the return path from the Ground Segment to the space segment for satellite operation and control.

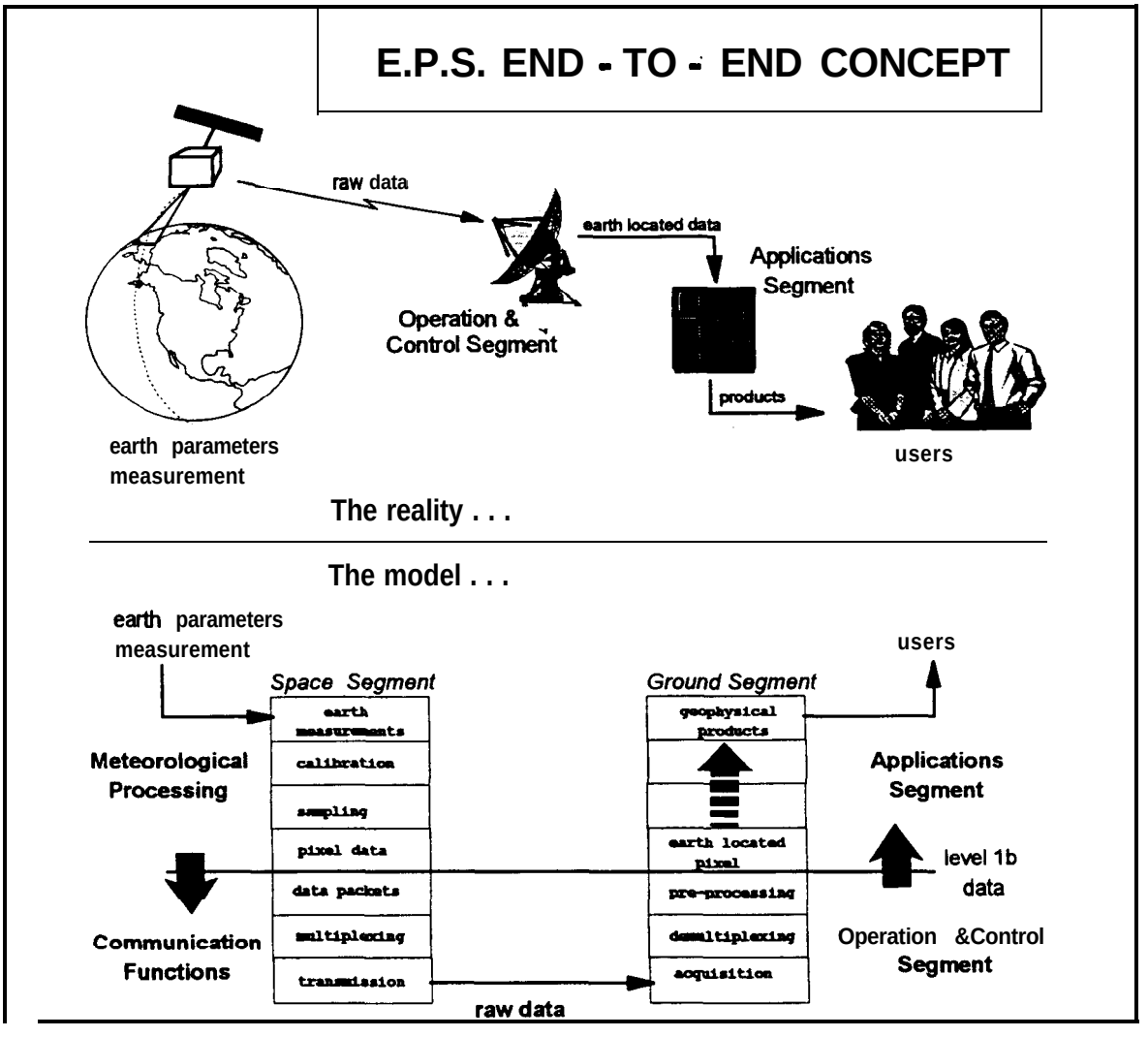

Figure - 3.1 : EPS system overview.

The earth parameters measured by the spacecraft instruments are processed on board to become a digital representation of an earth pixel. This information is then formatted into a packet structure and multiplexed with the other instruments'data, before being simultaneously stored on the tape recorder and broadcast via the High/ Low Rate Picture

Transmission (HRPT/LRPT) links. After one orbit, the satellite returns into visibility range from the ground station. All data stored on board during one orbit is dumped to the Command and Data Acquisition (CDA) station. During this operation the CDA station also receives all telemetry data and sends commands to the satellite. The CDA station performs the raw data acquisition and local storage before further processing in the Ground Segment.

The Ground Segment is divided into two parts, the Operation and Control segment and the Application segment. The Operation and Control segment is responsible for the satellite control and overall mission management, including the raw data acquisition via the CDA station, and the delivery of the quality controlled and earth located data to the Application segment. The Application segment is then responsible for the processing of the earth located data into geophysical products, for the archiving and for the distribution of all products to the user community. Different categories of users are considered.

Global data users are defined as European centres running operational NWP models to produce global forecasts. Centres in Europe currently considered as global data users are: the U.K. Meteorological Office (Bracknell), Deutscher Wetter Dienst (Offenbach), Météo France (Toulouse) and ECMWF (Reading). Developments in other centres may be added to this list within the time-frame of EPS. Regional data users are EUMETSAT Member States' centres who run operational NWP models for regional rather than global areas. There are more users of this type than global data users. The last category comprises the local data users. They are distributed globally and receive the LRPT or HRPT direct broadcast from the satellite. The number of HRPT users worldwide is more than 200 and is growing. These users include both major forecast centres and small forecast offices many of whom are subsidiaries of main national centres.

To fulfil the EPS mission and to provide the end users with the required services, the Ground Segment shall perform the following tasks.

The acquisition of raw data, also called level 0 data, from both EPS and NOAA satellites for the orbits visible from the CDA station location. This also includes the capabilities to receive satellite housekeeping and telemetry data, and to up link the commands to the satellite.

The EPS mission overall management including the satellite operations and control, the mission planning and control and the Ground Segment monitoring and control.

The data preprocessing transforming the raw data into quality controlled, calibrated and earth located data, also called level lb data, as required for the computation of the various geophysical products.

The generation of the geophysical products, also called level 2 & level 3 data, from the level lb data. These products are quality controlled before their dissemination to the user community.

The storage of global level lb data and global geophysical products into an EPS archive. This function includes the archiving of the data the catalog management and the retrieval of stored information on request from the users.

- The transmission of data, products, commands and control messages between the elements of the Ground Segment. The transmission is performed using communication links and communication networks. This can either be local connections between co-located elements or international communication links between remote elements.
- The delivery of data and products to the user community, including the handling of user requests to access the EPS archive for consultation of the catalog and / or for information retrieval.

4. EPS GROUND SEGMENT FUNCTIONAL BREAKDOWN

The EPS Ground Segment has been described in the previous section by means of the different tasks performed. This section details the system concept for a functional breakdown of those tasks and the corresponding architecture. The interactions between the different functional elements are then further analyzed. The functional architecture presented in this section does not imply a particular physical implementation of the various elements of the Ground Segment. Elements functionally distinct can be co-located and similarly a single logical function can be implemented using several sub-systems physically separated in different locations. The breakdown of the functions to be supported by the Ground Segment to fulfil the various tasks behoving the mission is presented in Figure 4.1.

4.1 EPS Operation and Control Segment

4.1.1 The Command and Data Acquisition stations

The Polar CDA Station (PCDAS), located at a high northern latitude (Kiruna - TBC), receives the data from the METOP satellite during the orbits visible from the station location plus the data from the NOAA satellite during the orbits not coveted by the NOAA Fairbanks (Gilmore) ground station. Antennae and receiving chain will be dedicated to the EPS mission.

The on board tape recorder data dump is initiated when the satellite enters in the visibility range of the ground station. The data collected, from the meteorological instruments and possibly also from the climate instruments (TBC), during the recorder data dump is available from the direct broadcast link (HRPT). Therefore the PCDAS is complemented with a Polar Local Data Receive Facility (PLDRF) for the reception of the direct broadcast data. The PCDAS will remove overlap data and merge the tape recorder dump and the direct broadcast data before transmission of the complete orbit to the preprocessing function (TBC). The CDA station is also responsible for the uplink of satellite commands and for the reception of satellite housekeeping telemetry.

A CDA station backup facility will guarantee the security of the mission and the continuity of the service. This is provided by a second station called Polar CDA Backup Station (PCDABS) having the same capabilities and functions as the main CDA station and also complemented by a PLDRF. Both PCDAS and PCDABS are connected to the data preprocessing facility and to the satellite operation and control centre. The switching between the main station and the backup station is under the responsibility of the EPS mission control centre.

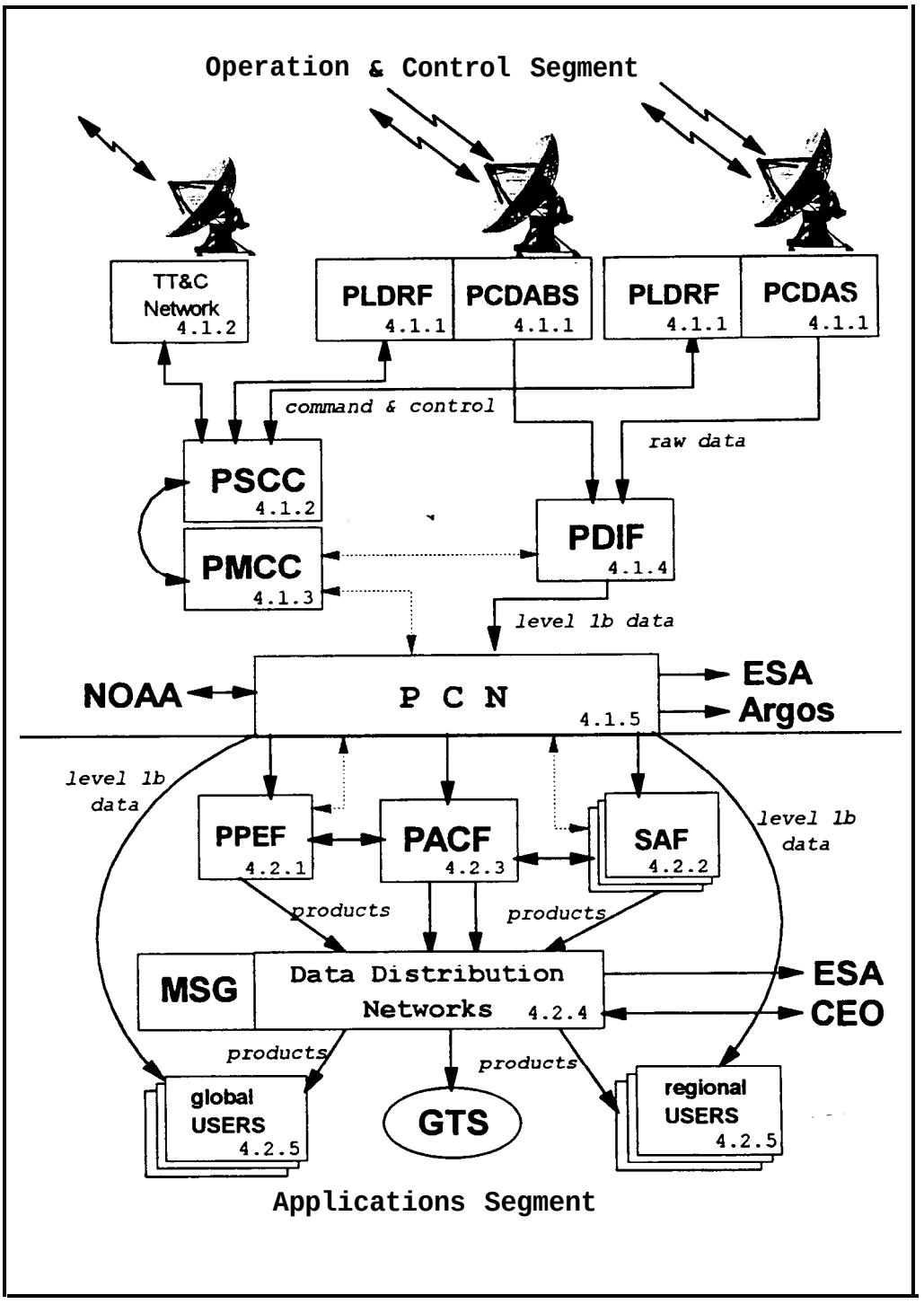

Figure - 4.1 : EPS Ground Segment functional breakdown

4.1.2 The satellite operation and control centre

The Polar Satellite Control Centre (PSCC) generates the commands to be transmitted to the spacecraft and to the instruments via the PCDAS and monitors the health and safety of the spacecraft and instruments with the received satellite telemetry data. The current technology should lead to a highly automated control centre for such an operational mission and therefore to a reduced operation staff. LEOP activities will be covered by an interface to an existing European TT&C network. Activities which require additional TT&C coverage such as support for non-nominal orbit correction manoeuvre, or emergency support will make use of the same interface to an existing TT&C network available on short notice request.

The operation of the satellite follows the procedures derived from the Satellite Users Manual provided by the satellite manufacturer. The instruments commands are generated according to a payload activity plan prepared by the EPS mission control centre. Any conflict in the payload activity plan is removed following an agreed strategy. The PSCC also analyses the satellite performances and records the spacecraft operational history for the whole duration of the mission.

4.1.3 The EPS mission control centre

The Polar Mission Control Centre (PMCC) ensures the coordination of the overall Ground Segment activity needed for a successful completion of the mission. The PMCC shall therefore be operational and manned 24 hours/day.

The PMCC prepares the payload activity plan for the PSCC, based on the mission requirements and on Application segment specific requests for instrument operation. It coordinates the activities of the products generation and development facilities and provides these facilities with required auxiliary data and information on the operational history of any instrument. An individual instrument operation plan, for each instrument, is maintained by the PMCC and updated as appropriate during the duration of the mission.

The PMCC forwards to the preprocessing facility the housekeeping data required for the generation of level lb data, ensure the adequate allocation of the resources and receives periodically in return the quality and performance reports. It is also responsible for the availability of the CDA station and control the encryption scheme utilised for the HRPT/LRPT direct broadcast.

4.1.4 The data preprocessing facility

The Polar Data Ingestion Facility (PDIF) receives the raw data coming from the CDA station and generates earth located, quality controlled and calibrated data which ate then forwarded to the Application segment for products generation. This function is implemented on an operational basis with all the necessary equipment redundancy required to face unexpected situation and guarantee the continuity of the service. Periodically, the PDIF generates quality and performance reports for the PMCC. Level lb data are processed for both the METOP satellite and for the NOAA blind orbit (TBC) covered by the EPS Ground Segment.

4.1.5 The internal interface to the Application segment

The Polar Communication Network (PCN) interfaces between the Operation and Control segment and the Application segment. It performs the function of level lb data router to the various entities which require the information for their weather forecast models or for the generation of the geophysical products.

As described in the EPS system overview, this communication function is utilised for the global exchange of data, at level lb (TBC), between EUMETSAT and NOAA. It also forwards the level lb data to ESA and the demultiplexed ARGOS data to the corresponding user entity.

The management and control messages from the PMCC to the Application segment, and the operation requests from the Application segment to the PMCC are also transmitted via the PCN.

4.2 EPS Application Segment

The Application segment performs all the functions related to the generation of the geophysical products, to the maintenance of the archive for both measurement data and products; and interfaces with the user community. The Application segment functional breakdown is based on a networked concept for meteorological processing with a central node located in the EUMETSAT H/Q. The decenttalisation leads to the establishment of centres of excellence. These centres may be housed in the national meteorological service of EUMETSAT Member States. In the terminology of the EPS Ground Segment, these centres of excellence are named Satellite Application Facilities (SAF). They are of two kinds. Those related to the generation of operational products on a regular basis and those involved with new development and the data processing from pre-operational instruments.

4.2.1 The central products generation facility

A centrally located Polar Product Extraction Facility (PPEF) will generate key level 2 meteorological products for general distribution. The PPEF also has the important task of providing general support and expertise to the routine management of the system as a

whole. This includes monitoring the performance of key satellite missions, providing feed-back on calibration and similar technical issues plus providing expertise during emergency situations, to safeguard the performance and life of the instruments.

4.2.2 **The** Satellite Application Facilities (SAP)

Several centres will be established in EUMETSAT member states, each one dealing with a specific domain of expertise, to provide level 2 meteorological products not generated by the PPEF, and/ or pre-opemtional research activities. The collection of all products derived by all the PPEF and the **SAFs** will **fulfil** the operational requirements of the user community.

The distribution of the products to the user community will be done through the data distribution networks; and all products plus the description of the corresponding algorithm will be stored into the EPS archive **(TBC).**

The data processing from pre-operational instruments and the development of new products or new algorithms for existing instruments will also be carried out by the **SAFs.** Those activities have no operational requirements to maintain due the research and development nature of the work accomplished. All pre-opemtional products, including the description of the processing performed, will be stored in the **EPS** archive for the whole duration of the mission **(TBC).**

The Infrared Advanced Sounding Instrument **(IASI)** project team can be included in the EPS Ground Segment as a dedicated SAF dealing with a pre-operational instrument **(TBC).** The Polar IASI-SAP **(P-IASI-SAF)** will receive the global instrument data from the Operation and Control segment and will be responsible for the processing, archiving and distribution of data and products to the non operational meteorological user community.

The **SAFs** have an interface to the PMCC for the reception of auxiliary data required for their processing and development work, for the transmission of any specific request on instrument mode of operation, on mission monitoring data and for overall mission management functions.

4.2.3 The EPS archive

The **EPS** archive will store all measurements data and products resulting from the **METOP** and NOAA **(TBC)** satellites for the whole duration of the mission. This function is performed by the Polar Archive and Catalog Facility **(PACF).** Besides the storage of the information, the PACF maintains a catalog of all information in the archive and provides the appropriate tools for the consultation and data retrieval. The user community will access the archive facilities through a user interface accommodated on the data distribution networks while the PPEF and **SAFs** will have separated access to the archive due to their different functionality inside the Application segment.

4.2.4 Data distribution networks

The Data Distribution Networks (DDN) have two main functions. The first function is a communication function to distribute all products generated by the Application segment to the end users. The second function is to serve as a central access to the PACF. It must therefore have the necessary facilities to handle the communication with the users community, to provide consultation of the catalog for all data and information available in the archive, and to retrieve and transmit the quested information from the archive to the end users.

The data distribution networks can be common to MSG system and as such can also serve for data and products exchange with the MSG ground segment for cross- validation purpose. It can distribute the EPS products to ESA, and can provide a gateway to the Centre for Earth Observation - CEO (TBC).

4.2.5 The end user community

The end user community represented in figure 4.1 comprises global data users running operational NWP models to produce global forecast, and regional data users running NWP models for regional rather than global areas. These NWP models require level lb data transmitted from the PCN. Both global and regional users also receive in parallel, via the DDN, all the products generated by the PPEF and SAFs.

The end user community constitutes a part of the Application segment. It is therefore the responsibility of EUMETSAT to define the appropriate tools for the end users to interface with the EPS Ground Segment. These tools comprise the equipment for the reception of the level lb data and meteorological products, up to an agreed interface; plus the communication package for the connection to the DDN for consultation of the EPS archive.

The end users considered in the Application segment are either running global prediction models or regional models. Local users which receive the direct broadcast from the HRPT/LRPT, are not represented here. However, EUMETSAT should also undertake a similar work for the definition and standardisation of the equipment and algorithm required by these local users.

Finally, a selection of the meteorological products generated by the EPS Ground Segment are transmitted to the GTS for the WWW users.

5 END USERS REQUIREMENTS

5.1 Meteorological mission

The meteorological mission requirements are expressed in the EPS End User Requirements Document (AD- 2). This document has been prepared by the EPS Data and Products working Group made up of representatives of EUMETSAT Member States.

5.2 Climatology Mission

The end users requirements for the climatology mission are still in the process of being gathered by corresponding working group. They will be introduced at a later stage into the End User Requirements Document (AD- 2).

5.3 Pre-operational Instrument(s) Mission

5.3.1 IASI instrument

The end users requirements for the IASI instrument are still in the process of being gathered by a corresponding working under the responsibility of CNES/ASI and with the collaboration of EUMETSAT. They will be introduced at a later stage into the End User Requirements Document (AD- 2).

6 SYSTEM FUNCTIONAL REQUIREMENTS

6.1 List of General System Requirements

[1.1] The EPS Ground Segment shall be autonomous and independent from other existing or planned ground segments, but not isolated (e.g. gateway to existing TT&C network).

[1.2] The EPS Ground Segment shall be capable to handle three satellites simultaneously for global data acquisition (two in the morning orbit, and one in the afternoon orbit); and to control two satellites in the morning orbit.

[1.3] The EPS Ground Segment shah be designed for an operational lifetime of at least 15 years. All constituting elements shall be designed with a modular upgrade/ exchange capability and the sizing of the functions will be dimensioned accordingly.

u-41 The EPS Ground Segment shall maintain an uninterrupted 24 hours/day operation throughout the year.

[1.5] The EPS Ground Segment shall provide satellite operation and control functions with a global reliability figure of 99.8 %

[1.6] The EPS Ground Segment shah deliver the products defined in the End User Requirements (AD- 2) within the timeliness requirement with a reliability of 99.8 %assuming that 100 % of the necessary raw data are transmitted from the satellites.

[1.7] Appropriate recovery procedures and critical elements redundancy shah be implemented in order to guarantee the continuity of the operation and services provided by the EPS Ground Segment.

[1.8] The EPS Ground Segment is part of an operational environment and therefore emphasis shall be placed on providing accurate, quality controlled and validated products.

[1.9] The system shall be able to evolve to meet changing requirements is areas such as new algorithms to be utilised for satellite operation and control procedures and/ or products generation. These modifications will be introduced and tested in parallel, via a pre-operational phase overlapping with the current operational service and without any degradation of performances to normal operation.

[1.10] Facilities for new product algorithms development shall be accommodated in parallel to the operational ground system.

[1.11] The design of the EPS Ground Segment shall provide a system which can effkiently

and cost effectively be operated and maintained.

[1.12] The EPS Ground Segment shah provide compatibility with the NOAA Ground Segment data processing functions each time this is necessary to guarantee coherence of global data from both morning and afternoon missions.

6.2 Operation & Control Segment

6.2.1 The Command and Data Acquisition stations

[2.1.1] The CDA stations shall include as a minimum the following elements :

- global data acquisition element
- telemetry reception and command transmission element
- satellite ranging element
- HRPT data reception element (PLDRF) attached to the CDA station communication with the PSCC and PDIF

[2.1.2] The EPS Ground Segment shah include a main CDA station at Kiruna (TBC) and a backup CDA station on locations to be defined including appropriate switching mechanism between the two stations. [NOTE: the baseline foresees two CDA stations (main and backup), additional options are described in section 6.4.3]

[2.1.3] The CDA stations shall include S-band equipment providing for commands and ranging uplink, and for telemetry downlink to and from the EPS satellites. The CDA station will interface with the satellite control centre for the exchange of telemetry, telecommands, and ranging.

[2.1.4] The CDA stations shall include X-band equipment acquiring global data from the morning satellites (EUMETSAT) for all visible orbits, and from the afternoon satellite (NOAA) for visible orbits which are not covered by the NOAA CDA station.

[2.1.5] The CDA stations shall include satellite ranging facilities.

[2.1.6] The CDA stations shall include local reception facilities (PLDRF) for the acquisition of HRPT/ LRPT satellite direct broadcast.

[2.1.7] The PLDRF shall be utilized to monitor the quality of the direct broadcast service, HRPT/LRPT and report to the PSCC/PMCC.

[2.1.8] The PLDRF shall acquire the HRPT data during the recorder data dump procedure.

[2.1.9] The CDA station shall remove overlap data and perform the merging and sequencing of the tape recorder dump (X-band) and the direct broadcast data (HRPT) before

transmission of the complete orbit to the preprocessing function (PDIF). [NOTE: alternative scenarios are TBD and evaluated]

[2.1.10] A local storage of the received data, and telemetry shall be maintained for a limited period of time (TBD) to guarantee the availability of the data.

[2.1.11] Communication facilities shall be provided from both main and backup CDA stations to the PSCC and to the PDIF.

[2.1.12] The transmission of the raw data from the PCDAS to the PDIF shall satisfy data quality and timeliness requirements expressed in (AD- 2). An equivalent service shall be available between the PCDABS and the PDIF.

[2.1.13] The switching of the communication facilities between the main station to the backup station and reverse shall be controlled and commanded by the PSCC/ PMCC.

[2.1.14] CDA stations activity plan shall be received from the PSCC/ PMCC in anticipation of satellites passes covered by the station.

6.2.2 The satellite operation and control centre [PSCC]

[2.2.1] The PSCC shall support the following mission phases :

- prelaunch campaign (e.g. compatibility tests with the satellite)
- launch and early orbit operation (LEOP), by interfacing with an existing network
- satellite in-orbit commissioning
- routine operation of the satellite (including emergency operation)

[2.2.2] The PSCC shall include as a minimum the following elements :

- the spacecraft control element
- the flight dynamics element
- the spacecraft simulator
- a communication gateway to the CDA stations and to other network(s) (LEOP and emergency)
- an interface to the PMCC

[2.2.3] The satellite operation and control centre shall perform all necessary tasks to assure uninterrupted operation of the METOP satellite.

[2.2.4] The PSCC shall generate the commands for the satellite, including the Meteorological Communication Package (MCP) and all instruments. The instruments commands are generated according to the payload activity plan prepared by the

mission control centre and validated by the PSCC against satellite operation constraints before transmission to the satellite. The generation and scheduling of telecommands is an off-line process prepared before the satellite pass over the CDA station.

[2.2.5] The PSCC shall ensure the correct operation of all instruments and MCP, monitor their performances and maintain a database of instrument housekeeping telemetry.

[2.2.6] The PSCC shall monitor and adjust the satellite orbit and attitude, including ranging processing activities.

[2.2.7] The PSCC shall include a satellite simulator and provide the adequate facilities for staff training, operation simulation and test tools for fault diagnostics (space segment), command validation, integration and commissioning of new systems and upgrades.

[2.2.8] The PSCC shall maintain an operation database with the satellite history, orbit and attitude data, satellite configuration data, scheduling and event log.

[2.2.9] Communication/ interface functions shall be provided between the PSCC and the PMCC to ensure the objective of overall mission control and coordination according to the division of responsibilities between the two sub-systems.

[2.2.10] The PSCC shall forward instrument housekeeping telemetry to the PMCC for instrument quality assessment procedures.

[2.2.11] The PSCC shall include backup facilities and redundancy as required by an operational environment.

[2.2.12] The PSCC shall provide efficient Man Machine Interface tailored to the requirements of an operational environment.

6.2.3 The EPS mission control centre [PMCC]

[2.3.1] The PMCC shall include as a minimum the following elements :

- the mission planning and scheduling element
- the payload/ instruments and MCP management element
- the Ground Segment control element (not limited to the actual PSCC and PMCC control but also including the complete Ground Segment control)
- a simulator of all Ground Segment facilities (processing capabilities, storage, communication links,. .)
- an instrument quality assessment element

[2.3.2] The PMCC shall coordinate and control the entire Ground Segment activities and ensure the availabiity of the resources.

[2.3.3] The PMCC shall generate the activity plan in preparation for all visible orbits covered by the CDA station(s).

[2.3.4] The PMCC is responsible for the payload (instruments and MCP) activity planning. It shall therefore maintain up to date the activity plan, check any modification submitted by the PPEF or SAFs against instruments operation manual and missions objectives, and incorporate them as appropriate. in the next version of the plan. All consecutive versions of the plan need to be kept for the all duration of the mission.

[2.3.5] The PMCC shall assess METOP instruments quality and maintain up to date an instruments calibration parameters database following procedures TBD.

[2.3.6] The PMCC shall distribute the instruments calibration parameters to the other elements of the Ground Segment (e.g. PDIF, local users,..) for daily operation or provide them on request for a past given date.

[2.3.7] The PMCC shall coordinate with NOAA for the exchange of all information (TBD- e.g. instrument calibration parameters) required for daily operation, such as to guarantee the compatibility of level lb data from both a.m. and p.m. satellites distributed by each ground segment.

[2.3.8] The PMCC shall generate the administrative messages for up-link to the MCP via the PSCC.

[2.3.9] The PMCC shall centralise all information from the different element of the Ground Segment regarding system performances, data and product quality and general operation status. This information will be regularly compiled into an EPS operation report.

[2.3.10] The PMCC shall liaise with the related ground segments such as NOAA, DRS (see OPT-l), ESA, IASI and MSG where appropriate, to ensure the required level of coordination.

[2.3.11] The PMCC shall include a simulation model and corresponding tools of the entire Ground Segment for staff training, operation simulation, fault diagnostic, integration and commissioning of new elements and upgrades.

[2.3.12] The PMCC shall control all Ground Segment communication links in the PCN and in the DDN, plus the switching between the main CDA station and the backup CDA station.

[2.3.13] The PMCC shall control encryption and conditional access as appropriate for the

HRPT/LRPT links (see RD-9 for details on the encryption mechanism and protocol). EPS and MSG encryption and conditional access facilities shall be combined (TBC) .

[2.3.14] The PMCC shall include backup facilities and redundancy as required by an operational environment.

[2.3.15] The PMCC shall provide efficient Man Machine Interfaces tailored to the requirements of an operational environment.

6.2.4 The data preprocessing facility [PDIF]

[2.4.13] The PDIF shall include as a minimum the following elements :

- the raw data reception (from CDA) element
- the level lb data preprocessing element
- a local control element connected to the PMCC
- a router for the addressing of the level lb data to the different destinations

[2.4.2] The PDIF shall receive the satellite raw data from the CDA stations and optionally also from NOAA (see option 3 in section 6.4.4)

[2.4.3] The PDIF shall be able to process the raw data for the visible orbits from two METOP morning satellites (one undergoing commissioning) and for the blind orbit coverage of the afternoon satellite from NOAA. This is the baseline scenario considering that the global data exchange between EUMETSAT and NOAA is performed at level lb (see also option 3).

[2.4.4] The raw data shall be demultiplexed per instruments before further processing.

[2.4.5] The PDIF shall extract all satellite telemetry from the raw data and forward it to the PSCC.

[2.4.6] The PDIF shall extract from instrument housekeeping telemetry all the parameters required for, and calculate the calibration coefficients to be applied in the pre-processing of raw data to level 1 b.

[2.4.7] The PDIF shall process instrument raw data stream to level lb, earth located and calibration applied (applied versus appended is TBC).

[2.4.8] The PDIF shall include all facility to control the quality of the data preprocessing and appropriate means to routinely report to the PMCC.

[2.4.9] The PDIF shall provide all required facility to cope with the requirements of an operational environment, with the introduction of new processing (growth potential)

into operation, and with a list of problem solving procedures; all this to guarantee the continuity of the service.

[2.4.10] The PDIF shall extract a regional sub-set of level 1b data as required by regional users.

[2.4.11] The PDIF shall generate auxiliary data (TBC) as required in the End Users Requirements document (AD- 2).

[2.4.12] The PDIF shall format the level 1b data according to a TBS format.

[2.4.13] The PDIF shall be responsible for the addressing of level 1b data, per instrument, subset of data, and per destination according to a table provided and controlled by the PMCC. The list of destination for the level 1b data sets shall include the copy going to the archive (PACF) following the End User Requirements.

[2.4.14] The PDIF shall then forward all formatted and addressed data to the PCN which is responsible for the transmission/ distribution.

[2.4.15] The PDIF shall operate under the control of the PMCC for all mission related aspects.

6.2.5 The Polar Communication Network [PCN]

[2.5.1] The PCN shall include as a minimum the following elements :

- a network control element
- a high rate distribution network for level 1b data
- a low rate network for the Ground Segment management and control

[2.5.2] The PCN shall deliver the preprocessed, formatted and addressed data at level 1b, coming from the PDIF, to the global and regional users, to the PPEF, to the SAFs and to the PACF.

[2.5.3] The PCN shall distribute and control the delivery of level 1b data, per instrument and per destination (PPEF, SAFs, PACF and users), and ensure that all required instrument data are correctly received. A file delivery log shall be automatically generated and periodically reported to the PMCC.

[2.5.4] The PCN shall provide the addressing scheme required by the distribution process.

[2.5.5] The PCN shall guarantee that the access to the information is restricted to the entitled entities in the system.

[2.5.6] The PCN shall provide the adequate facilities to control and monitor all communication links included in the networks.

[2.5.7] The PCN control facility shall follow the instructions from the PMCC and periodically report on activities to the PMCC.

[2.5.8] The PCN shall provide the adequate communication facilities for the PMCC to communicate with the PPEF and SAFs for daily operation and Ground Segment coordination activities.

[2.5.9] The PCN shall provide an interface to NOAA Ground Segment for global data exchanges.

[2.5.10] The PCN shall provide an interface to ESA for level 1b data distribution.

[2.5.11] The PCN shall provide all required communications facilities for the PMCC to communicate with the NOAA ground segment and exchange operation related information (TBD).

[2.5.12] The PCN shall include backup facilities to guarantee the continuity of the operation.

6.3 Application Segment

6.3.1 Centralised Products Generation Facilities [PPEF]

[3.1.1] The PPEF shall include as a minimum the following elements :

- reception of level 1b data element
- centralized products generation element
- a router facility for the addressing of the products to the different destination
- a local control facility connected to the PMCC

[3.1.2] A centrally located Polar Products Extraction Facility (PPEF) shall generate key level 2 and level 3 meteorological products as specified in the End Users Requirements document (AD- 2). The fraction of the products which is to be generated in this centralised function is TBD.

[3.1.3] The PPEF shall receive level 1b data from the PDIF.

[3.1.4] The PPEF shall generate all products according to the operation plan prepared by the PMCC and periodically report on its activity.

[3.1.5] The PPEF shall perform a control of the quality for the different products which are generated and include this information in the activity report for the PMCC.

[3.1.6] The PPEF shall interface with the PMCC payload management element for the exchange of information related to instruments operation.

[3.1.7] The PPEF shall interface with the PMCC Ground Segment control element for all management functions and related procedures.

[3.1.8] The PPEF shall organise the distribution of all generated products to the users, to the SAFs, to the archive and to the GTS following the distribution table prepared by the PMCC. The distribution itself is the responsibility of the DDN.

[3.1.9] The PPEF shall provide adequate facilities for parallel off-line development and validation of new algorithms before introduction into the operational environment.

[3.1.10] The PPEF shall provide efficient Man Machine Interface procedures tailored to the requirements of an operational environment.

[3.1.11] The PPEF shall include all required facilities to access the PACF, interrogate and retrieve data and products.

[3.1.12] The PPEF shall include backup facilities and redundancy as required by an operational environment.

6.3.2 Decentralised Satellite Application Facilities [SAF]

[3.2.1] Each SAF shall include as a minimum the following elements :

- reception of level 1b data (from PDIF) element
- products generation (operational/ pre-operational/ new development) element
- a router facility for the addressing of the products to the different destinations
- a local control facility connected to the PMCC

[3.2.2] The Ground Segment shall accommodate a number (TBS) of SAFs generating operational products, and/ or pre-operational products from pre-operational instruments (e.g. IASI); and/ or performing algorithm development research work.

[3.2.3] The allocation of the operational products between the different SAFs and scenarios for the distribution of activities between the SAFs for the generation of operational and pre-operational products, and for the development of new algorithms is TBD.

[3.2.4] The SAFs in charge of the operational products shall generate key level 2 and level 3 meteorological products as specified in the End Users Requirements document (AD- 2).

[3.2.5] The SAFs shall receive level 1b data from the PDIF.

[3.2.6] The SAFs in charge of operational products shall follow the operation plan prepared by the PMCC and periodically report on their activity.

[3.2.7] The SAFs in charge of operational products shall perform a control of the quality and include this information in the activity report for the PMCC.

[3.2.8] The SAFs shall interface with the PMCC payload management element for the exchange of information related to instruments operation.

[3.2.9] The SAFs shall interface with the PMCC Ground Segment control element for the Ground Segment management functions and related procedures.

[3.2.10] The SAFs in charge of operational products shall organise their distribution to the users, to the PPEF, to the other SAFs, to the PACF and to the GTS following the distribution table prepared by the PMCC. The distribution itself is the responsibility of the DDN.

[3.2.11] The SAFs shall provide, when applicable, adequate facilities for parallel off-line development and validation of new algorithms before introduction into the operational environment.

[3.2.12] The SAFs in charge of operational products shall provide efficient Man Machine Interface procedures tailored to the requirements of an operational environment.

[3.2.13] The SAFs shall include all required facilities to access the PACF, interrogate and retrieve data and products.

[3.2.14] The SAFs in charge of operational products shall include backup facilities and redundancy as required by an operational environment.

6.3.3 Polar Archives [PACF]

Introductory note :

The archive function is a very complex element of the EPS Ground Segment and its design optimisation is of paramount importance. The functional requirements expressed hereafter and the functional breakdown which represent the PACF as a centralised element does not intend to favour one or another solution (centralized versus decentralized) for the actual physical implementation of the EPS archive(s).

[3.3.1] The PACF shall archive all global data and products generated by the EPS Ground Segment as specified in the End User Requirement (AD- 2).

[3.3.2] The PACF shall maintain and automatically update a catalogue of all information

contained in the EPS archive(s).

[3.3.3] The PACF shall archive all data and products following recognised standard (TBD) and possibly comply with corresponding international recommendations being prepared for the IEOS by the CEOS working group on data.

[3.3.4] The PACF shall provide an efficient environment and related facilities for the interrogation of the EPS database and retrieval of stored data and products.

6.3.4 Data Distribution Networks [DDN]

[3.4.1] The DDN shall deliver the already formatted and addressed level 2 and 3 products generated by the PPEF and SAFs to their different destinations : the PPEF, the SAFs, the PACF, the global and regional users and to the GTS.

[3.4.2] The DDN shall distribute and control the delivery of all products, per products and per destination, and ensure that all data are correctly received. A file log shall be automatically generated and periodically reported to the PMCC.

[3.4.3] The DDN shall provide the adequate facilities to control and monitor all communication links included in the network.

[3.4.4] The DDN shall provide the addressing scheme required by the distribution process.

[3.4.5] The DDN shall guarantee that the access to the information is restricted to the entitled entities in the system.

[3.4.6] The DDN shall provide an interface with MSG for operation related products exchange, as described in section 7.8 of the specifications.

[3.4.7] The DDN shall provide an interface with ESA for the delivery of products generated by the PPEF and SAFs, as described in section 7.10.

[3.4.8] The DDN shall provide an interface (TBC) with CEO for accessing the EPS archive, as described in section 7.11.

[3.4.9] The DDN shall provide the communication facilities for the End User community and the product generation facilities (PPEF and SAFs) to access the EPS archive and for the delivery of the retrieved data or products to their destinations.

[3.4.10] The DDN control facility shall follow the instructions from the PMCC and periodically report on activities to the PMCC.

6.4 List of options for system design

The current assumption made for the EPS Ground Segment are referred to as the baseline scenario. This baseline has been presented in section 4 : EPS Ground Segment Functional Breakdown. Different alternatives, called hereafter options, have been identified for further investigations and optimisation of the system concept, during the phase A. This section recalls the baseline and describes the identified options.

6.4.1 Summary of the current baseline scenario

- Global data acquisition relies on on-board recording and data dump, once per orbit, to a EPS CDA station(s) located in Kiruna (TBC) plus a data dump of the blind orbits to the NOAA CDA station in Fairbanks (Gilmore). Data acquisition for NOAA blind orbits is performed from the EPS CDA station(s).

- The global data exchange between EUMETSAT and NOAA is performed after preprocessing (at level 1b - calibration applied) of the received data in the Ground Segment which has performed the data acquisition.

- TT&C backup relies on a backup CDA station located in Europe, while LEOP and emergency situation are covered by the provision of a gateway from the EPS Ground Segment to an existing European network providing this service on request.

6.4.2 OPTION - 1: The utilisation of the Data Relay Satellite(s)

The baseline for the EPS system concept relies on the utilisation of EPS CDA stations at locations in Northern Europe, Kiruna (TBC) and a backup, plus the utilisation of the NOAA Fairbanks (Gilmore) CDA station during blind orbits.

An alternative to this approach consist in the utilisation of the DRS. This option shall cover:

- the possible utilisation of one or two DRS as the main mechanism for global data acquisition from the satellite(s), supported by backup CDA station(s); including implications on CDA station(s) requirements.

- the possible utilisation of one or two DRS as a backup mechanism to the EPS CDA station(s) for both global data acquisition and operation and control of the METOP satellite(s); including implications on CDA station(s) requirements

- the possible utilisation of one or two DRS as a main mechanism for both global data acquisition and operation and control of the METOP satellite(s); supported by backup CDA station(s); including implications on CDA station(s) requirements.

6.4.3 OPTION - 2 : Location of the EPS CDA and backup strategy.

The baseline scenario relies on the utilisation of two EPS CDA stations, a main station at Kiruna (TBC) and a backup station TBD. The telemetry and telecommand of the satellite relies on the EPS CDA stations (main and backup) for normal operation, while LEOP and emergency situation are covered by the provision of a gateway to an external existing network. The EPS CDA station(s), in Northern Europe, perform the global data acquisition for all visible orbits, complemented by the NOAA Fairbanks (Gilmore) for blind orbit support. The satellite ranging is performed using a single CDA station in the EPS Ground Segment.

DRS alternatives to this baseline are already listed under option 1. This option shall cover the following points :

- the optimisation of the two EPS CDA stations (main and backup) localisation and analysis of the corresponding orbits coverage and operation scenario.

- the necessity to provide a backup CDA station part of the EPS Ground Segment versus the utilisation of an existing network to backup a single EPS CDA station.

- the alternative solution(s) other than DRS for blind orbits coverage is case of the non availability of the NOAA Fairbanks CDA station.

- the additional requirements resulting from the support of NOAA K,L,M satellites by the EPS Ground Segment for blind orbit coverage. The baseline foresee to start the support with the NOAA satellite O,P,Q. The downlink characteristics of the K,L,M series are different from the O,P,Q series.

- the implications on the communication links requirements for all different scenarios, including the utilisation of the DRS.

6.4.4 OPTION - 3 : Level of global data for the exchange between EUMETSAT and NOAA

The baseline scenario foresees the exchange of global data between EUMETSAT and NOAA at level 1b (calibration applied to the data). [NOTE: definition of data level can be found in AD-2]

Two alternative scenarios are :

- the exchange of raw data between the two ground segments (no preprocessing performed before the exchange)

- the exchange of level 1a data (calibration appended by opposition to applied in level 1b)

This option shall cover the analysis of the baseline versus two alternative scenarios and their implication on the system design :

- the impact on the design of the preprocessing function (PDIF)
- the impact on operation resulting from the availability of blind orbit telemetry in case of raw data exchange (without any additional task to be performed by NOAA)
- the impact on the Ground Segment system design of the different alternatives (e.g. configuration and bandwidth of the communication links,..)
- the possible utilisation of compression technic to reduce the bandwidth of the transatlantic link
- the definition of the required coordination mechanism between NOAA and EUMETSAT corresponding to the different alternatives.

7 EXTERNAL INTERFACES REQUIREMENTS

Section 6 lists the functional requirements for the various elements constituting the Ground Segment. External interfaces have been identified between the EPS Ground Segment and the non EUMETSAT entities participating to the EPS mission. This section describes the functionalities to be provided and defines the content of the exchange which is performed. The full specification of the interfaces will not be achieved before the placing of the phase A contract. The purpose of the phase A study, as far as the external interfaces are concerned, will be to progress the definition and specification of the interfaces' requirements.

7.1 Satellite interface

The spacecraft interface is placed in the category of the external interfaces due to the configuration of the EPS project where the development and procurement of the METOP satellite in under the contractual responsibility of ESA. A feasibility study of the satellite will be performed in parallel to the Ground Segment phase A.

The preliminary assumption for the definition of the satellite interface to the EPS Ground Segment can be found in the METOP Space Segment Requirement Specifications (RD- 3)

7.2 Global users

The global users receive automatically the level 1b global data from the PDIF via the PCN, and the meteorological products generated by the PPEF and SAFs via the DDN. In addition, the global users have the possibility to access the PACF for catalog consultation and data retrieval. All interfaces between the global users and the EPS Ground Segment shall be standardised.

The preliminary assumption for the definition of the global users' interfaces to the EPS Ground Segment are described in RD- 4.

7.3 Regional users

The regional users receive automatically a subset of the level 1b global data from the PDIF via the PCN, and the meteorological products generated by the PPEF and SAFs via the DDN. In addition, the regional users have the possibility to access the PACF for catalog consultation and data retrieval. All interfaces between the regional users and the EPS Ground Segment shall be standardised.

The preliminary assumption for the definition of the regional users' interfaces to the EPS Ground Segment are described in RD- 4.

7.4 Local users

The local users receive the satellite direct broadcast data via the HRPT and/ or LRPT channels.

The facilities for accessing the PACF for catalog consultation and data retrieval will be made available to the local users, using standardised interfaces.

The preliminary assumption for the definition of the regional users' interfaces to the EPS Ground Segment are described in RD- 4.

7.5 GTS interface.

A subset of the products generated by the PPEF and SAFs shall be distributed automatically to the WWW users via the GTS network.

The preliminary assumption for the definition of the GTS interface to the EPS Ground Segment are described in RD- 4.

7.6 ARGOS

Data collected by ARGOS will be forwarded to the corresponding processing facilities located in Washington and in Toulouse, either via NOAA (as part of the global data exchange) or directly to the processing centre. Details are TBS.

7.7 IASI

IASI is a pre-operational instrument, developed by CNES and ASI, flying on the METOP satellite, providing valuable data to the meteorological users. The processing of the IASI data and the generation of the corresponding products is proposed to be accommodated in a dedicated SAF operated by the developing Agencies (TBC). The configuration of the interfaces to the IASI-SAF will evolve with the time as the instrument will have first a pre-operational/ qualification phase before entering into an operational phase.

Different interfaces between the IASI-SAF and the other elements of the EPS Ground Segment must be provided. The global data (pre-processed on board by the instrument) are forwarded to the IASI-SAF via the PCN. The products generated by the IASI-SAF and intended for the meteorological community are transmitted to the DDN responsible for the distribution function. In addition, the instrument development team will have the possibility to dialogue with the PMCC for any instrument operation request and monitoring purpose. This interface is provided via the PCN. Finally, an archive of IASI products shall be maintained in the PACF. This function can either be centralised or located in the IASI-SAF. Interface to the archiving facilities shall be provided for the full range of functionalities supported by the Application segment.

All the interfaces between the IASI-SAF and the other elements of the EPS Ground Segment should be the compatible with the standardised interface definition for EPS SAFs.

The preliminary assumption for the definition of the IASI interfaces to the EPS Ground Segment are described in RD- 6.

7.8 MSG interface.

An interface shall be provided between EPS and MSG for the exchange of data for cross-validation purpose.

Interface details are TBD during Phase - A.

7.9 NOAA

The interface to NOAA covers the exchange of the global data at level 1b (baseline scenario, see option-3), and the exchange of coordination information (TBD) required by each ground segment for the operation of the preprocessing function. In addition, S&R telemetry from the morning satellite will be forwarded from EUMETSAT to NOAA.

The preliminary assumption for the definition of the NOAA interface to the EPS Ground Segment are described in RD- 5

7.10 ESA

The EPS Ground Segment interface to ESA shall cover the delivery of polar data to ESA, the operation procedures for ESA provided instruments and the utilisation of the DRS.

The preliminary assumptions for the definition of the ESA interfaces to the EPS Ground Segment are described in RD- 7.

7.10.1 Delivery of polar data to ESA

The EPS Ground Segment shall deliver the following data from both morning and afternoon satellites :

- off-line, raw data from all instruments except ASCATT and MIMR
- near real time, global ASCATT and MIMR raw data
- near real time, level 1b data from all instruments

All interfaces between EUMETSAT and ESA for data delivery shall be compatible with standardised definition developed for the EPS Ground Segment.

NOTE : EUMETSAT is responsible for the generation of MIMR and ASCATT products requested by the User Community and to be added in the corresponding section of the End User Requirements Document (AD-2).

NOTE : ESA access to the EPS archive(s) shall follow standar lised interface and procedure developed for the End User Community.

7.10.2 Operation of ESA procured instruments

The operation of ESA procured instruments shall be performed by the implementation in the PMCC mission operation plan of a defined strategy. A straight forward type of operation is foreseen with some special needs for instrument calibration. The operation plan will be regularly updated on ESA request. The details of the procedure for the update of the plan and the definition of the adequate means to exchange the messages are TBD.

7.10.3 Interface to DRS

The utilisation of the DRS for global data acquisition and/or for TM&TC is investigate under option 1. The utilisation of the DRS implies the definition of a number of interfaces to the corresponding facilities. This shall include :

- an interface between the PDIF and the DRS User Earth Terminal, for global data acquisition
- an interface between the PSCC and the DRS User Earth Terminal, for satellite TM&TC
- an interface between the PMCC and the DRS Mission Control Centre for overall mission coordination and DRS resources availability

7.11 Centre for Earth Observation (CEO)

The CEC is leading an initiative to develop a network concept interconnecting databases from various earth observation mission in Europe. EUMETSAT contemplate the possibility to provide a gateway on the EPS Ground Segment to allow CEO users the access to the archiving facilities of the polar mission.

The definition of the CEO concept is at an early stage and further analysis are still required. This potential interface is only mentioned for the sake of completeness, no effort should be dedicated to this element during phase A.

7.12 European TT&C network

The EPS Operation & Control segment will not include the facilities for LEOP activities. This will be provided by an existing European network to which the EPS Ground Segment

will interface during launch and early orbit. The provision of the gateway to an European TT&C network has therefore to be accommodated in the design of the system. The same gateway and corresponding facilities will be re-utilised for orbit manoeuvre and in case of emergency during the operational lifetime of the satellite.

Interface details are TBD during Phase - A.

8 GLOSSARY

A/D	Analog-to-Digital
AATSR	Advanced Along Track Scanning Radiometer
AES	Atmospheric and Environmental Service
AIRS	Atmospheric Infra-Red Sounder
AKM	Apogee Kick Motor
ALADIN	Atmospheric LAser Doppler INstrument
AMAS	Advanced Millimeter wave Atmospheric Sounder
AMI	Active Microwave Instrument
AMPS	Active Microwave Pressure Sounder
AMRIR	Advanced Medium Resolution Infra-Red Radiometer
AMSU-A	Advanced Microwave Sounding Unit A
AMSU-B	Advanced Microwave Sounding Unit-B
AO	Announcement of Opportunity
APOLLO	AVHRR Processing system Over cLoud, Land and Ocean
APT	Analogue Picture Transmission
ARGOS	Meteorological Data Collection and Location System
ASCATT	Advanced Scatterometer
ASI	Agenzia Spaziale Italiana
ATLID	ATmospheric LIDar
ATMOS	Atmospheric Trace Molecules Observed by Spectroscopy
ATOVS	Advanced TIROS Operational Vertical Sounder
ATSR	Along Track Scanning Radiometer
AVHRR	Advanced Very High Resolution Radiometer
BAHC	Biospheric Aspects of the Hydrological Cycle
BMRC	Bureau of Meteorological Research Centre
bps	bits per second
BTE	Bench Test Equipment
BUFR	Binary Universal Form for Representation of meteorological data
c.m.	centre of mass
cal/val	Calibration and Validation
CCDH	Command Communications Data Handling
CCSDS	Consultative Committee on Space Data Systems
CDA	Command and Data Acquisition
CDR	Critical Design Review
CEO	Centre for Earth Observation
CEOS	Committee of Earth Observation Satellites
CERES	Clouds and Earth's Radiant Energy System experiment
CFC	Chloro-Fluro-Carbons
CIU	Control Interface Unit
CMS	Centre de Meteorologie Spatiales
CNES	Centre National d'Etudes Spatiales

CPS	Complimentary Platform System
CXU	Command Annex Unit
dB	decibel
DCP	Data Collection Platform
DCS	Data Collection System
DDN	Data Distribution Networks
DIAL	DIfferencial Atmospheric Lidar
DMSP	Defence Meteorological Satellite Programme
DORIS	Doppler Orbitography and Radio-positioning Integrated by Satellite
DRS	Data Relay Satellite
EC	European Commission
ECMWF	European Centre for Medium range Weather Forecasting
EGSE	Electrical Ground Support Equipment
ELT	Emergency Location Transmitter
EM	Engineering Model
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ENVISAT	ENVIronmental SATellite
EOS	Earth Observing System
EPIRB	Emergency Position Indicating Radio Beacon
EPOP	ESA Polar Orbiting Platform
EPS	EUMETSAT Polar System
ERBE	Earth Radiation Budget Experiment
ERS-1	European Remote-sensing Satellite-1
ERS-2	European Remote-sensing Satellite-2
ESA	European Space Agency
ESTEC	European Space Research & Technology Centre
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAR	Flight Acceptance Review
FM	Flight Model
FMECA	Failure Mode Effects and Criticality Analysis
FOV	Field of View
GAC	Global Area Coverage
GAW	Global Atmosphere Watch
GBW	Gap BandWidth
GCOS	Global Climate Obsering System
GCTE	Global Change Terrestial Ecosystems
GENIUS	Global Environmental Network Information and USer
GEWEX	Global Energy and Water Experiment
GFE	Government-Furnished Equipment
GHz	Gigaherz

GIIS	General Instrument Interface Specification
GLOSS	Global Sea Level Observing System
GOEZS	Global Ocean Euphotic Zone Study
GOME	Global Ozone Monitoring Experiment
GOMOS	Global Ozone Monitoring by Occultation of Stars
GPCP	Global Precipitation Climatology Project
GRDC	Global Run-off Data Centre
GSE	Ground-Support Equipment
GSFC	Goddard Space Flight Center
GTS	Global Telecommunications System
HIRDLS	HIgh Resolution Dynamic Limb Sounder
HIRS	High resolution InfraRed Sounder
HPBW	Half-Power BeamWidth
HRPT	High Resolution Picture Transmission
Hz	Herz
IASI	Infrared Atmospheric Sounding Interferometer
ICD	Interface Control Document
ICSU	International Council of Scientific Unions
IEOS	International Earth Observation System
IF	Intermediate Frequency
IGBP	International Geosphere-Biosphere Programme
IGOSS	Integrated Global Ocean Services System
IMU	Inertial Measurement Unit
IOC	Intergovernmental Oceanographic Commisssion
IPCC	Inter-governmental Panel on Climate Change
IR	Infra-Red
IRTS	Infra-Red Temperature Sounder
ISCCP	International Satellite Cloud Climatology Project
ISDN	Integrated Services Digital Network
ISLSCP	International Satellite Land Surface Climatology Programme
ITPP	International TOVS Processing Package
ITS	Interferometer Thermal Sounder
JGOFS	Joint Global Ocean Flux Study
JPOP	Japanese Polar Orbiting Platform
K	degrees Kelvin
KBS	Knowledge Based System
Kbps	Kilo bits per second
KHz	Kilo Herz
LAN	Local Area Network
LAWS	Laser Atmospheric Wind Sounder

LRPT	Low Rate Picture Transmission
Mbps	Mega bits per second
MCP	Meteorological Communications Package
MERIS	Medium Resolution Imaging Spectrometer
METOP	Meteorological OPerational satellite
MHS	Microwave Humidity Sounder
MHz	Mega Herz
MIMR	Multi-frequency Imaging Microwave Radiometer
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MK2	(SPOT) Mark 2 (Bus)
MODIS	MODerate Resolution Imaging Spectrometer
MOP	Meteosat Operational Programme
MSG	Meteosat Second Generation
MSU	Microwave Sounding Unit
MTP	Meteosat Transition Programme
MTS	Microwave Temperature Sounder
NASA	National Aeronautics and Space Administration
NASDA	Nippon Aeronautics and Space Development Administration
NEΔT	Noise Equivalent Differencial Temperature
NESDIS	National Environmental Satellite, Data and Information Service
NMC	National Meteorological Centre
NOAA	National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
PAC	Policy Advisory Committee
PACF	Polar Archive Central Facility
PBW	Passband Width
PCDAS	Polar Command and Data Acquisition Station
PCDABS	Polar Command and Data Acquisition Backup Station
PCN	Polar Communication Network
PDIF	Polar Data Ingestion Facility
PDR	Preliminary Design Review
PDSF	Polar Development Service Facility
PLDRF	Polar Local Data Reception Facility
PMCC	Polar Mission Control Centre
POEM	Polar Orbiting Environmental Mission
POLDER	POLarization and Directionality of Earth Reflectances
PPEF	Polar Product Extraction Facility
PPF	Polar PlatForm
PPL	Preferred Parts List
PRARE	Precise Range And Rate Experiment
PSCC	Polar Satellite Control Centre
PSN	Packet Switched Network

PSR	Preshipment Review
R & QA	Reliability and Quality Assurance
RA	Radar Altimeter
RF	Radio Frequency
RFI	Radio Frequency Interference
RMS	Root Mean Square
ROM	Rough Order of Magnitude
ROSIS	Reflective Optics System Imaging Spectrometer
RSMC	Regional or Specialised Meteorological Centre
RTOVS	Revised TIROS Operational Vertical Sounder
S&R	Search and Rescue
SAF	Satellite Application Facility
SAR	Synthetic Aperture Radar
SBUV	Solar Backscatter Ultra Violet
SC	StratoCumulus
ScaRaB	Scanner for Earth's Radiation Budget
SCIAMACHY	Scanning Imaging Absorption spectroMeter for Atmospheric CHartographY
SEM	Space Environment Monitor
SM	Structural Model
SMHI	Swedish Meteorological and Hydrological Institute
SOW	Statement of Work
SPL	Sound Pressure Level
SR	Special Review
SRD	System Requirements Document
SSD	Sun Sensor Detector
SSM/I	Special Sensor Microwave/Imager
SST	Sea Surface Temperature
St	Stratus
STG	Scientific and Technical Group
SWCC	Second World Climate Conference
TBC	To Be Confirmed
TBD	To Be Defined
TIP	TIROS Information Processor
TIROS	Television Infra-Red Observing Satellite
TM	TeleMetry
TOGA	Tropical Ocean and Global Atmospheric Programme
TOMS	Total Ozone Mapping Spectrometer
TRMM	Tropical Rainfall Monitoring Mission
TT&C	Tracking Telemetry and Command

UIID	Unique Instrument Interface Document
UIIS	Unique Instrument Interface Specification
VHF	Very High Frequency
VIRSR	Visible and Infra-Red Scanning Radiometer
VIS/IR	Visible / Infra-red
VSAR	Variable frequency Synthetic Aperture Radar
WCP	World Climate Programme
WMC	World Meteorological Centre
WMO	World Meteorological Organisation
WOCE	World Ocean Circulation Experiment
WWW	World Weather Watch
XSU	Cross-Strap Unit
μm	micrometre (microns)
μw	microwaves
8SP	8-second Synchronisation Pulse